CEE 471
Introduction to Environmental Engineering

Catalog data:	20-CEE-471. Introduction to Environmental Engineering. 3 ug. cr. Theory and overview. Principles of environmental engineering and stewardship as applied to watershed protection, drinking water production, sewage treatment, air pollution prevention and treatment, environmental policy, and public opinion formation.
Prerequisites:	Chemistry and biology.
Textbook:	Davis and Cornwell, *Introduction to Environmental Engineering*, 3rd Edition, McGraw-Hill Book Co., New York, NY, 1998.
References:	Select articles from the peer-reviewed literature.
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Goals:	This course provides a broad overview of environmental engineering including the protection of air, land, and water using physical, chemical, and biological principles. This course is intended to introduce students to the breadth of problems tackled by and technologies employed by environmental engineers. A balance is struck between an emphasis placed upon open-ended questions, engineering problems and exams testing the principles of environmental engineering.
Lecture or lab topics:	1. Introduction to environmental engineering and overview of materials balance and systems approaches to mixed media (5 classes) 2. Hydrology, ground water, and environmental water quality (4 classes) 3. Drinking water treatment. (6 classes) 4. Sewage treatment (6 classes) 5. Air pollution regulation, prevention, and treatment (6 classes) 6. Hazardous waste, Superfund sites, environmental policy, and public opinion formation (3 classes)
Computer usage:	Spreadsheet modeling as part of three extended homework assignments including: (1) the fate and transport of contaminants or pathogens in a watershed or estuarine systems; (2) determining the least cost solution to water pollution treatment or air pollution treatment from point sources; and (3) dissolved oxygen sag in a river due to biochemical oxygen demand.
ABET criterion 3:	a, e, f, g, h, j

ABET criterion 8: a, c

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Specific Examples of ABET Criterion 3

a: Extensive, open-ended homework assignments are used throughout the class including the development of an optimum least-cost solution to point source pollution in an air shed. The students are provided air pollution production from two points sources. They are also provided with unit costs for treatment of air pollution for each point source. The homework assignment requires the students to develop an air dispersion model and solve a constrained optimization problem to find the least cost solution to air pollution treatment given a maximum permissible ground level air pollution limit.

e: See the description in A, above.

g: One of the extensive homework assignment requires the students to review the popular literature to learn about the problem of PCBs dumped in the Hudson River basin by General Electric Co. during the production of transformers for electric power. After researching the problem, each student prepares a five page essay documenting the scope of the problem (including technical backup and references), and ultimately develops a personal opinion of who is responsible for the problem and what action should be undertaken to clean up the mess. Since this problem is highly debated in the popular press, the students typically have a lot of information to review and each student struggles with generating a personal opinion based upon the available information. The students are required to review relevant literature on the use of pesticides in agriculture and the effects of persistent pesticides on animals and aquatic life. They need to discuss optimum solutions of application of pesticides balancing their beneficial effect in agriculture and their harmful effects to humans, mammals, and aquatic organisms.

f: In the introductory lecture, students create a group definition of environmental engineering with a focus upon environmental stewardship. Throughout the course, we revisit and update this definition as the students learn more about environmental engineering and the critical differences between environmental engineering and environmentalism.

h: One activity that relates to broad impacts of engineering on society is our in-class review of the Three Mile Island nuclear disaster. We begin the three-day lecture with an overview of the benefits of nuclear power and the ability of nuclear power generation to reduce pollution as compared to conventional fossil fuel power plants. Then, we watch a video documentary of the Three Mile Island disaster. After reviewing the video, the students debate the responsibilities of engineering professionals to help public officials make important decisions, and they learn about the important but difficult role technical experts have in public policy development and implementation. The students also learn how environmental agencies impose regulations considering a balance between treatment costs and effectiveness of available treatment technologies, quality of source water, and health risk assessment. We finally review a series of three video tapes on the role of environmental engineers for providing potable water and the challenges of our profession

considering the great risks of contaminated water, especially with pathogenic microorganisms.

j: See the description in G, above.